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US9584330B2	Specification Support	Big-IP Policy Enforcement Manager (The accused product)
1Pre. A method for generating a real time billing information in a packet switching based network, wherein a call is set up between a user of said packet switching based network and a user of a circuit switching based network, and wherein a billing server is informed of at least a billing rate and an interval of billing, the method comprising the steps of:	a method **for generating a real time billing information in a packet Switching based network**. This method may be for example applied to the IMS network [Col. 3, Line 51-54]	The accused product practices a method for generating a real time billing information in a packet switching based network, wherein a call is set up between a user of said packet switching based network and a user of a circuit switching based network, and wherein a billing server is informed of at least a billing rate and an interval of billing. F5 Networks provides BIG-IP Policy Enforcement Manager (i.e. PEM) for a service provider that offers network flexibility, improved network performance, and controls delivery of traffic. See Fig. 1 and Fig. 2. **Citation 1: BIG-IP Policy Enforcement Manager**  Fig. 1 Source: https://www.f5.com/products/big-ip-services/policy-enforcement-manager, Page 1, Last accessed June 26, 2020, Exhibit A

Exhibit 2

Citation 2: Controls on subscriber traffic

BIG-IP PEM effectively manages network traffic to optimize performance or enforce controls on traffic via subscriber- and application-aware policies. BIG-IP PEM provides subscriber- and/or application-aware bandwidth-controlling mechanisms via rate limiting, DSCP marking, and layer 2 QoS marking. These limits can be applied to a group of subscribers, to all subscribers, at the application level, or per subscriber per application level.

Fig. 2

Source: https://www.f5.com/pdf/solution-center/f5-handbook-for-service-providers-guide.pdf, Page 10, Last accessed June 26, 2020, Exhibit B

F5 Network helps service providers deliver fast and secure Voice over Long-Term Evolution (i.e. VoLTE) service through the usage of the accused product that enables control of traffic delivery. See Fig. 3 and Fig. 4.

Citation 3: Fast and secure VoLTE service

F5 HELPS YOU:

- Deliver fast and secure VoLTE and IMS services.

Fig. 3

Source: https://www.f5.com/pdf/solution-center/f5-handbook-for-service-providers-guide.pdf, Page 6, Last accessed June 26, 2020, Exhibit B

Exhibit 2

		Citation 4: VoLTE is crucial for service providers VoLTE is crucial for service providers, consolidating voice traffic from circuit switch networks to all-IP LTE networks, thereby reducing overall network operation costs. As the rate of VoLTE adoption rapidly increases, attacks against the signaling resources used to provide services—including real-time signaling protocols—will also increase. As a result, VoLTE security which focuses on protecting and controlling signaling protocols, including Diameter and SIP, is becoming more critical. Fig. 4 Source: https://www.f5.com/pdf/solution-center/f5-handbook-for-service-providers-guide.pdf, Page 6, Last accessed June 26, 2020, Exhibit B BIG-IP Policy Enforcement Manager (PEM) supports the integration with an online charging system (OCS) that allows the service provider Fig. Fig. . As an example, when the subscriber of an LTE (service provider) network (i.e. packet-switched based network) makes a call to a user of a circuit-switched based network such as 2G, 3G network, BIG-IP PEM in LTE network Fig. Fig. . **Citation 5: Integration with OCS** Leveraging BIG-IP PEM, operators can integrate with the online charging system (3GPP) and define quotas which are tracked per subscriber/application. This allows service providers to bill the subscribers appropriately and charge them for quota renewals. Fig. 5

Exhibit 2

Source: https://www.f5.com/pdf/solution-center/f5-handbook-for-service-providers-guide.pdf, Page 11, Last accessed June 26, 2020, Exhibit B

Citation 6: Real-time charging through OCS

OCS is a specialized communications function that allows a service provider to charge a user for services in real-time. The OCS handles the the subscribers account balance, rating, charging transaction control and correlation. With the OCS, a telecom operator ensures that credit limits are enforced and resources are authorized on a per transaction basis.

Fig. 6

Source: https://www.dialogic.com/glossary/online-charging-system-ocs, Page 1, Last accessed June 1, 2020, Exhibit C

Citation 7: Real-time charging through OCS

BIG-IP PEM classifies traffic based on application type, offering new ways to provide tailored services for subscribers, generate new revenue, and increase customer satisfaction. Application charging and quota management allow for customized service plans based on subscriber requirements. For example, if subscribers are interested in a VoIP package, they can opt into a plan with unlimited VoIP usage for an additional fee. Likewise, subscribers interested in a business package can pay a fee to access service-enabling business applications without affecting their data caps.

Fig. 7

Source: https://www.f5.com/pdf/solution-center/f5-handbook-for-service-providers-guide.pdf, Page 20, Last accessed June 26, 2020, Exhibit B

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		Citation 8: LTE is based on a packet-based network **How it works:** LTE operates in a range of frequencies, including the 700 MHz band in which the Federal Communications Commission has set aside a block of spectrum for the public safety network. It is built on TCP/IP and provides a packet-based alternative to earlier circuit-switched wireless networks, offering the ability to support a variety of devices using multiple services, including voice, video and data. Fig. 8 Source: https://gcn.com/articles/2013/04/08/why-lte-is-the-next-generation-in-wireless.aspx, Page 1, Last accessed June 26, 2020, Exhibit H **Citation 9: VoLTE is a specific type of VoIP** VoLTE stands for Voice over Long-term Evolution. Utilizing the IMS (IP Multimedia Subsystem) technology, it is a specific type of VoIP service designed into the LTE standard, which enables users to make voice calls while simultaneously using data network LTE. Simply put, VoLTE (voice over LTE) delivers the voice service as data flows within the LTE data bearer and enables high-speed wireless communications for mobile phones and other data terminals. Fig. 9 Source: https://www.yeastar.com/blog/whats-difference-volte-and-voip/, Page 1, Last accessed June 1, 2020, Exhibit D BIG-IP Policy Enforcement Manager (i.e. network element) comprises Policy and Charging Enforcement Function (PCEF) that communicates through messages to inform monetary (i.e. billing rate) and non-monetary (e.g. time) units with the OCS of the service provider's network. OCS uses the cost of service and duration of service (e.g. call) usage and generates Cost-Information (i.e. billing information) in real-time. As an example, the

Exhibit 2

subscriber of the LTE network (i.e. service provider's network) uses the VoLTE calling service to communicate with cellular switched based, where the service provider uses the OCS to charge for the call and generate real-time billing information. Fig. Fig.

Citation 10: PEM communicates with OCS

You can use the Policy Enforcement Manager™ to implement quota management process for prepaid subscribers per session and per application. You can provision prepaid charging per subscriber or application that communicates with the quota protocol endpoint (QPE), such as online charging system (OCS), over the 3GPP Gy interface. The Gy endpoint allows online credit control for Layer 4 to 7 service data flow-based charging. This type of policing is called quota management; this feature ensures that subscribers do not consume resources that are not authorized. The Diameter Credit-Control Application (DCCA) specifies an approach based on a series of interrogations, that use Credit-Control-Request (CCR) and Credit-Control-Answer (CCA) messages.

Fig. 10

Source: https://techdocs.f5.com/content/kb/en-us/products/big-ip-pem/manuals/product/pem-implementations-12-1-0/_jcr_content/pdfAttach/download/file.res/BIG-IP_Policy_Enforcement_Manager__Implementations.pdf, Page 35, Last accessed June 26, 2020, Exhibit E

Citation 11: Message shares between the PCEF and the OCS

Online charging uses IETF Diameter Credit Control application. It uses the Gy reference point in the 3GPP standards for messages between the Online Charging Server and the PCEF. The PCEF requests resource allocation and reports credit control information to the OCS (Online Charging System). Event Charging with Unit Reservation (ECUR) using CCR Initial and Termination can be used to generate event messages.

Online charging has two sub-functions:

- Unit determination, that refers to the calculation of the number of non-monetary units like service units, data volume, time and events that shall be assigned prior to starting service delivery. PEM uses the Session Charging with Unit Reservation (SCUR) system.

Exhibit 2

<table>
<tr>
<td></td>
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<td>Fig. 11
Source: https://techdocs.f5.com/content/kb/en-us/products/big-ip-pem/manuals/product/pem-implementations-12-1-0/_jcr_content/pdfAttach/download/file.res/BIG-IP_Policy_Enforcement_Manager__Implementations.pdf, Page 35, Last accessed June 26, 2020, Exhibit E

Citation 12: Network element (PCEF) sends CCR to OCS

Step 2. In order to perform Reserve Units operation for a number of units (monetary or non-monetary units), the network element sends a Credit-Control-Request (CCR) with CC-Request-Type AVP set to INITIAL_REQUEST to the OCS. If known, the network element may include Requested-Service-Unit (RSU) AVP (monetary or non monetary units) in the request message.
Step 3. If the service cost information is not received by the OCS, the OCS determines the price of the desired service according to the service specific information received by issuing a rating request to the Rating Function. If the cost of the service is included in the request, the OCS directly reserves the specified monetary amount. If the credit balance is sufficient, the OCS reserves the corresponding amount from the users account.
Step 4. Once the reservation has been made, the OCS returns Credit-Control-Answer (CCA) message with CC-Request-Type set to INITIAL_REQUEST to the network element in order to authorize the service execution (Granted-Service-Unit and possibly Cost-Information indicating the cost of the service and Remaining-Balance AVP are included in the Credit-Control-Answer message). The OCS may return the Validity-Time (VT) AVP with value field set to a non-zero value. The OCS may indicate in the Low-Balance-Indication AVP that the subscriber account balance has fallen below a predefined threshold of this account.
Step 5. Content/service delivery starts and the reserved units are concurrently controlled.
Fig. 12
Source: https://www.etsi.org/deliver/etsi_ts/132200_132299/132299/10.07.00_60/ts_132299v100700p.pdf, Page 59, Last accessed June 26, 2020, Exhibit F</td>
</tr>
<tr>
<td>1a. generating, via a network element, a first message with a first</td>
<td>firstly, in step 401, a first message with a first token indicating</td>
<td>The accused product practices a method that comprises generating, via a network element, a first message with a first token that indicates the billing rate upon receipt of a first charge</td>
</tr>
</table>

Exhibit 2

token that indicates the billing rate upon receipt of a first charge message that contains said billing rate from said circuit switching based network and based on said first charge message, wherein the billing server is informed of said billing rate;	**the billing rate is generated upon receiving a first charge message from said circuit Switching based network** and based on said first charge message, and the billing server is informed said billing rate. [Col. 3, Line 59-63] The **token "Tariff" refers to the billing rate of a call.** Therefore, the AS could get the billing rate from this message and the billing server is informed of that billing rate. [Col. 4, Line 5-8]	message that contains said billing rate from said circuit switching based network and based on said first charge message, wherein the billing server is informed of said billing rate. BIG-IP Policy Enforcement Manager comprises Policy and Charging Enforcement Function (PCEF) that communicates with the OCS and allows credit control (i.e. controlling the charges) for services (e.g. VoLTE call). The accused product uses a Session Charging with Unit Fig. Fig. . The SCUR system is initiated when a user initiates and sends a session request to the service provider network, which is received by the PCEF (or CTF) and communicated with OCS for real-time charging. See Fig. 15. **Citation 13: PEM communicates with OCS** You can use the Policy Enforcement Manager™ to implement quota management process for prepaid subscribers per session and per application. You can provision prepaid charging per subscriber or application that communicates with the quota protocol endpoint (QPE), such as online charging system (OCS), over the 3GPP Gy interface. The Gy endpoint allows online credit control for Layer 4 to 7 service data flow-based charging. This type of policing is called quota management; this feature ensures that subscribers do not consume resources that are not authorized. The Diameter Credit-Control Application (DCCA) specifies an approach based on a series of interrogations, that use Credit-Control-Request (CCR) and Credit-Control-Answer (CCA) messages. Fig. 13 Source: https://techdocs.f5.com/content/kb/en-us/products/big-ip-pem/manuals/product/pem-implementations-12-1-0/_jcr_content/pdfAttach/download/file.res/BIG-

Exhibit 2

		IP_Policy_Enforcement_Manager__Implementations.pdf, Page 35, Last accessed June 26, 2020, Exhibit E **Citation 14: Messages shares between PCEF and OCS** Online charging uses IETF Diameter Credit Control application. It uses the Gy reference point in the 3GPP standards for messages between the Online Charging Server and the PCEF. The PCEF requests resource allocation and reports credit control information to the OCS (Online Charging System). Event Charging with Unit Reservation (ECUR) using CCR Initial and Termination can be used to generate event messages. Online charging has two sub-functions: • Unit determination, that refers to the calculation of the number of non-monetary units like service units, data volume, time and events that shall be assigned prior to starting service delivery. PEM uses the Session Charging with Unit Reservation (SCUR) system. Fig. 14 Source: https://techdocs.f5.com/content/kb/en-us/products/big-ip-pem/manuals/product/pem-implementations-12-1-0/_jcr_content/pdfAttach/download/file.res/BIG-IP_Policy_Enforcement_Manager__Implementations.pdf, Page 35, Last accessed June 26, 2020, Exhibit E

Exhibit 2

Citation 15: Session initiation happens by user

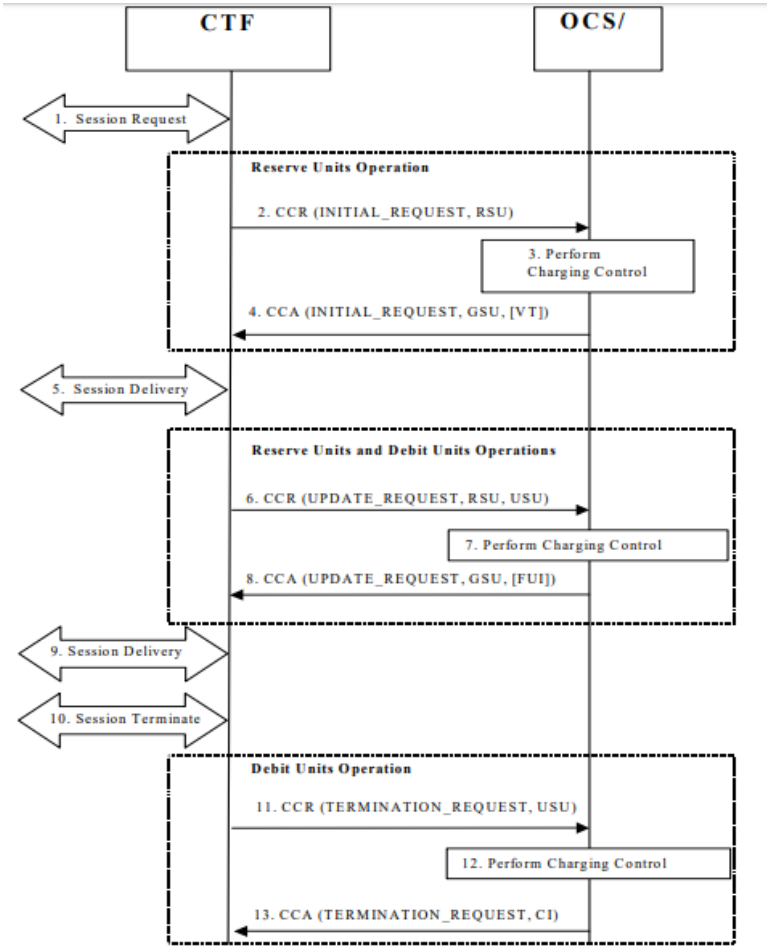

Figure 6.3.5: SCUR for session based credit control

Step 1. The network element receives a session initiation. The session initiation may be done either by th user or the other network element.

Fig. 15

Exhibit 2

		Source: https://www.etsi.org/deliver/etsi_ts/132200_132299/132299/10.07.00_60/ts_132299v100700p.pdf, Page 59, Last accessed June 26, 2020, Exhibit F As an example, a user-A of an LTE network (i.e. Packet switched based network) initiates a voice call to a user B of a 2G network (i.e. Circuit switched based network), the 2G network sends the intercarrier charges of their network towards the LTE network to charge the service provider of LTE network who thereby charges the user A. See Fig. 16. BIG-IP Policy Enforcement Manager (Fig. . **Citation 16: Intercarrier charges** **Intercarrier compensation** refers to the charges that one carrier pays to another carrier to originate, transport, and/or terminate telecommunications traffic. Although the same or similar facilities are used to originate, terminate and transport all types of traffic, the rates for intercarrier compensation vary based on several factors: ▪ Where the call begins and ends (whether the call is local or long distance, and whether it is interstate or intrastate) ▪ What types of carriers are involved (incumbent local carriers, competitive local carriers, long distance providers, wireless carriers) ▪ What type of traffic (wireline voice calls, wireless calls, data bound for an Internet service provider) Fig. 16 Source: https://www.fcc.gov/general/intercarrier-compensation-0, Page 1, Last accessed June 26, 2020, Exhibit G

Exhibit 2

Citation 17: Cost of the service in CCR

Step 2. In order to perform Reserve Units operation for a number of units (monetary or non-monetary units), the network element sends a *Credit-Control-Request* (CCR) with *CC-Request-Type* AVP set to INITIAL_REQUEST to the OCS. If known, the network element may include *Requested-Service-Unit* (RSU) AVP (monetary or non monetary units) in the request message.

Step 3. If the service cost information is not received by the OCS, the OCS determines the price of the desired service according to the service specific information received by issuing a rating request to the Rating Function. If the cost of the service is included in the request, the OCS directly reserves the specified monetary amount. If the credit balance is sufficient, the OCS reserves the corresponding amount from the users account.

Fig. 17

Source:

https://www.etsi.org/deliver/etsi_ts/132200_132299/132299/10.07.00_60/ts_132299v10070p.pdf, Page 59, Last accessed June 26, 2020, Exhibit F

Also, the OCS may use the non-monetary unit (e.g. time of voice call) to reserve the network resources that are involved in the session (e.g. call) to deliver uninterpreted service. See Fig. 18.

Citation 18: Non-monetary units comprises time

Unit determination refers to the calculation of the number of non-monetary units (service units, data volume, time and events) that shall be assigned prior to starting service delivery.

Fig. 18

Source:

https://www.etsi.org/deliver/etsi_ts/132200_132299/132299/10.07.00_60/ts_132299v10070p.pdf, Page 23, Last accessed June 26, 2020, Exhibit F

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		Note: Further Search/ Source Code Review/ Product Testing could help in gathering additional evidence related to the claim limitation "*receipt of a first charge message that contains said billing rate from said circuit switching based network*".
1b. once said call has been set up, generating, via the network element, a second message with a second token that indicates the interval of billing upon receipt of a subsequent charge message that contains said interval of billing and based on said subsequent charge message, wherein the billing server is informed of said interval of billing; and	once said call having been set up, a second message with **a second token indicating the interval of billing are generated upon receiving a Subsequent charge message and based on said Subsequent charge message, and the billing server is informed of said interval of billing.** The billing server is configured to generate the real time billing information continuously based on	The accused product practices a method comprises generating once said call has been set up, via the network element, a second message with a second token that indicates the interval of billing upon receipt of a subsequent charge message that contains said interval of billing and based on said subsequent charge message, wherein the billing server is informed of said interval of billing. As shown in Fig. 19, once the content/service delivery starts (i.e. call has been set up) the network element (i.e. accused product) sends a second Credit-Control-Request (CCR) with CC-Request-Type AVP (i.e. second message with a second token) to OCS that reports the units used (e.g. time or duration of a voice call). The second request message (CCR) includes a Request-Service-Unit AVP that can be a non-monetary unit (e.g. time interval of the voice call/ interval of billing) to charge the subscriber in real-time.

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	the billing rate and the interval of billing. [Col. 4, Line 9-16]	**Citation 19: unit send from the network element** Step 5. Content/service delivery starts and the reserved units are concurrently controlled. Step 6. During session delivery, in order to perform Debit Units and subsequent Reserve Units operations, the network element sends a CCR with *CC-Request-Type* AVP set to UPDATE_REQUEST, to report the units used and request additional units, respectively. The CCR message with *CC-Request-Type* AVP set to UPDATE_REQUEST must be sent by the network element between the INITIAL_REQUEST and TERMINATION_REQUEST either on request of the credit control application within the validity time or if the validity time is elapsed. If known, the network element may include *Requested-Service-Unit* AVP (monetary or non monetary units) in the request message. The *Used-Service-Unit* (USU) AVP is complemented in the CCR message to deduct units from both the user's account and the reserved units, respectively. Step 7. The OCS deducts the amount used from the account. If the service cost information is not received by the OCS, the OCS determines the price of the desired service according to the service specific information received by issuing a rating request to the Rating Function. If the cost of the service is included in the request, the OCS directly reserves the specified monetary amount. If the credit balance is sufficient, the OCS reserves the corresponding amount from the users account. Fig. 19 Source: https://www.etsi.org/deliver/etsi_ts/132200_132299/132299/10.07.00_60/ts_132299v100700p.pdf, Page 59-60, Last accessed June 26, 2020, Exhibit F Note: Further Search/ Source Code Review/ Product Testing could help in gathering additional evidence related to the claim limitation "*receipt of a subsequent charge message that contains said interval of billing and based on said subsequent charge message*".
1c. generating continuously, via said billing server, the real time billing information after receipt of the	**the real time billing information is generated by the billing server, on the basis of the billing rate and the interval of**	The accused product practices a method comprises generating continuously, via said billing server, the real time billing information after receipt of the billing rate and the interval of billing. The OCS communicates with the BIG-IP Policy Enforcement Manager to deduct the monetary amount (i.e. money) from the subscriber account using the Monetary amount

Exhibit 2

billing rate and the interval of billing.	**billing.** It should be noted that, according to the present method, the interval of billing could be set according to a demand of the subscribers. [Col. 4, Line 36-41]	(i.e. cost of service) and non-Monetary amount (i.e. time or duration of a voice call) used from the accused product. Once the deduction has been made, the OCS sends the Credit-Control-Answer (CCA) message that includes Cost-Information (i.e. billing information) to the network element (i.e. accused product) that allows user to view their billing in real-time. Also, BIG-IP Policy Enforcement Manager (CTF/PCEF) sends the CCR to OCS that includes monetary units (i.e. cost of service), as the deduction of reserved amount is made, to subsequently reserve monetary units (i.e. money from subscriber account) for the ongoing call to continuously deduct the monetary amount and generate the billing information in real-time. See Fig. 20. **Citation 20: OCS sends CCA to the network element** Step 6. During session delivery, in order to perform Debit Units and subsequent Reserve Units operations, the network element sends a CCR with *CC-Request-Type* AVP set to UPDATE_REQUEST, to report the units used and request additional units, respectively. The CCR message with *CC-Request-Type* AVP set to UPDATE_REQUEST must be sent by the network element between the INITIAL_REQUEST and TERMINATION_REQUEST either on request of the credit control application within the validity time or if the validity time is elapsed. If known, the network element may include *Requested-Service-Unit* AVP (monetary or non monetary units) in the request message. The *Used-Service-Unit* (USU) AVP is complemented in the CCR message to deduct units from both the user's account and the reserved units, respectively. Step 7. The OCS deducts the amount used from the account. If the service cost information is not received by the OCS, the OCS determines the price of the desired service according to the service specific information received by issuing a rating request to the Rating Function. If the cost of the service is included in the request, the OCS directly reserves the specified monetary amount. If the credit balance is sufficient, the OCS reserves the corresponding amount from the users account. Step 8. Once the deduction and reservation have been made, the OCS returns *Credit-Control-Answer* message with *CC-Request-Type* set to UPDATE_REQUEST to the network element, in order to allow the content/service delivery to continue (new *Granted-Service-Unit (GSU) AVP* and possibly *Cost-Information (CI) AVP* indicating the cumulative cost of the service and *Remaining-Balance* AVP are included in the *Credit-Control-Answer* message). The OCS may include in the CCA message the *Final-Unit-Indication* (FUI) AVP to indicate the final granted units. The OCS may indicate in the *Low-Balance-Indication* AVP that the subscriber account balance has fallen below a predefined threshold of this account. Fig. 20

Exhibit 2

		Source: https://www.etsi.org/deliver/etsi_ts/132200_132299/132299/10.07.00_60/ts_132299v10070p.pdf, Page 60, Last accessed June 26, 2020, Exhibit F

Exhibit 2

References Cited

Exhibit(s)	Description	Link
Exhibit A	BIG-IP Policy Enforcement Manager Product Page	https://www.f5.com/products/big-ip-services/policy-enforcement-manager
Exhibit B	F5 Handbook for Service Providers	https://www.f5.com/pdf/solution-center/f5-handbook-for-service-providers-guide.pdf
Exhibit C	What is Online Charging System	https://www.dialogic.com/glossary/online-charging-system-ocs
Exhibit D	What's the Difference between VoLTE and VoIP	https://www.yeastar.com/blog/whats-difference-volte-and-voip/
Exhibit E	BIG-IP Policy Enforcement Manager Implementations	https://techdocs.f5.com/content/kb/en-us/products/big-ip-pem/manuals/product/pem-implementations-12-1-0/_jcr_content/pdfAttach/download/file.res/BIG-IP_Policy_Enforcement_Manager__Implementations.pdf
Exhibit F	3GPP TS 32.299 version 10.7.0 Release 10	https://www.etsi.org/deliver/etsi_ts/132200_132299/132299/10.07.00_60/ts_132299v100700p.pdf
Exhibit G	Intercarrier Compensation	https://www.fcc.gov/general/intercarrier-compensation-0
Exhibit H	Why LTE is the next generation in wireless	https://gcn.com/articles/2013/04/08/why-lte-is-the-next-generation-in-wireless.aspx